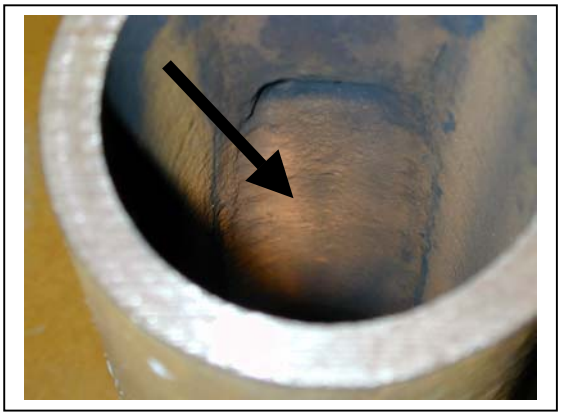
Low NO_X Modification

What are the Potential Penalties?

Addition of innovative low NO_X burner technology can often have unanticipated and undesirable side effects. Boiler modifications that add low NO_X burners, in combination with overfire air ports and/or flue gas recirculation, result in significant changes to the heat flux distribution, gas temperatures, gas mass flow rate, furnace pressures, etc. These modifications introduce new boiler damage mechanisms and will accelerate other mechanisms which, prior to the modifications, may not have been equipment life limiting. Some of these damage mechanisms and other adverse impacts are briefly described below.

Departure from Nucleate Boiling (DNB). Perhaps the most immediate and least understood threat to boiler reliability is this mechanism. It is caused by the increased heat flux near the furnace exit in concert with high steam quality, and low "Sized Circulation Ratio". This damage mechanism usually occurs when the unit is running at or near its design capacity. APTECH has observed, analyzed, and corrected a major problem resulting from DNB within a year after the low NO_X modification.



Example of DNB-Related Hot Side Steam Blanketing, Gouging, and Deposit Formation in a Waterwall Tube.

Accelerated Creep. The increased gas mass flow rates and gas temperatures that are produced by increased furnace pressure and the staged combustion associated with overfire air ports and gas recirculation will increase the temperature of the steam-cooled tubing. This increase in tube temperature will not produce immediate, short-term overheat failures, but will accelerate overheat/fireside wastage-type tube failures. In addition, increases in steam temperatures in the primary superheat outlet header will accelerate header creep fatigue damage.

Heat Rate Effects. Increased superheater and reheater spray flows are generally a consequence of low NO_X modifications. The increased (especially in the reheater) flows have a negative impact on heat rate and cycle efficiency.

Fireside Corrosion. Reducing combustion conditions associated with low NO_X modifications are known to increase fireside corrosion of tubing.

What does APTECH Bring to the Table?

- State-of-the Art-Inspection Technologies to Detect Problems. We wrote the original "Boiler Tube Failure Metallurgical Guide" which included evaluation of fossil boiler tubing, including low NO_X -influenced damage mechanisms.
- Comprehensive Models of Boiler Thermodynamics and Damage Mechanisms that are used to:
  - Predict Modification Impacts
  - Design Corrective Measures
- Practical Engineers with detailed working knowledge of plant operation and low NO_X modification designs that can ensure cost-effective improvements to emissions, damage, and heat rate issues
- Design, implementation and evaluation of "damage-influencing boiler testing" including requirements for special instrumentation
- Proprietary and patented boiler tube assessment and life extension modifications
- Experience with difficult boiler damage problems at many other plants
- A critical third party for review of design modifications

Additional Information

If you are interested in getting help on your Low NO_X Modification, please contact: Terry Rettig (trettig@aptecheng.com), Kevin Hara (khara@aptecheng.com) or Paul Grimsrud (pgrimsrud@aptecheng.com) at:

Aptech Engineering Services, Inc.
1253 Reamwood Avenue
Sunnyvale, CA 94089
408.745.7000 or 800.477.2228
Fax 408.734.0445
www.aptecheng.com